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# **Announcement of Opportunity**

## **Solar Terrestrial Relations Observatory (STEREO)**

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**Notice of Intent Due:**  
**Proposals Due:**

**May 28, 1999  
July 28, 1999**

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# ANNOUNCEMENT OF OPPORTUNITY FOR THE STEREO MISSION

## 1.0 DESCRIPTION OF THE OPPORTUNITY

### 1.1 Overall Description

The Solar TERrestrial RELations Observatory (STEREO) mission is the third in the line of Solar-Terrestrial Probes (STP) and is a strategic element of the Sun-Earth Connection Roadmap (see Appendix C for access information for this and related documents describing the STEREO mission). STP is a continuous sequence of flexible, cost-capped missions designed for sustained study of critical aspects of the Sun-Earth system. It is an outgrowth of the highly successful International Solar-Terrestrial Physics (ISTP) program.

The primary goal of the STEREO mission is to advance the understanding of the three-dimensional structure of the Sun's corona, especially regarding the origin of coronal mass ejections (CME's), their evolution in the interplanetary medium, and the dynamic coupling between CME's and the Earth environment. CME's are the most energetic eruptions on the Sun, are the primary cause of major geomagnetic storms, and are believed to be responsible for the largest solar energetic particle events. They may also be a critical element in the operation of the solar dynamo because they appear to remove dynamo-generated magnetic flux from the Sun.

STEREO will, therefore, continue the systematic study of the relationship between processes on the Sun and consequences for the Earth. The ejections of well-defined clouds of plasma from the corona were discovered in 1973 by instruments on NASA's Skylab/Apollo Telescope Mount. Although studies continued with the NASA Solar Maximum Mission and the ESA-NASA Solar and Heliospheric Observatory (SOHO) in the ISTP program, these investigations were limited to vantage points that best showed those CME's that missed the Earth. However, with two spacecraft sent in opposite directions away from the Sun-Earth line, the STEREO mission will finally allow unambiguous observations of those CME's that directly impact the Earth. STEREO will also for the first time provide a stereoscopic view of the three-dimensional corona and the interplanetary medium and thereby advance the Sun-Earth Connection understanding of the heliosphere begun by the ISTP program.

This Announcement of Opportunity (AO) solicits proposals for science investigations that address the objectives of the STEREO mission. The selected proposals are expected to provide scientific research investigations that include:

- the design, development, and delivery to NASA of flight hardware, in the form of identical pairs (one for each spacecraft) of either complete instruments or major suites of these instruments;
- participation in mission operations, data acquisition, and assistance in the assembly of the data from all instruments into a unified set, which will then be available for analysis by all participating scientists and the larger science community; and
- the analysis and timely publication of research articles based on the data from STEREO.

It is the intent of NASA to launch two spacecraft in approximately June 2004 with identical complements of instruments (see Section 5.1.5). The STEREO Science Definition Team (SDT), sponsored by NASA, has suggested an instrument complement to satisfy STEREO objectives consisting of:

- (1) An extreme ultraviolet (EUV) and/or X-ray telescope that images the chromosphere and the inner corona;
- (2) a white light coronagraph that images the inner to outer corona;
- (3) a radio receiver that studies shocks from outer corona to beyond Earth;
- (4) a visible light telescope that images the interplanetary medium and disturbances therein;
- (5) a plasma analyzer that samples both CME and ambient plasmas at 1 AU;
- (6) a sensor that detects magnetic fields inside and outside CME's; and
- (7) detectors of prompt and delayed electrons and ions from 0.1 to 100 MeV.

Proposals in response to this solicitation are expected to present broad scientific investigations that contribute to the total mission and not just to the interpretation of the data from the particular instrument(s) they propose to provide. They shall describe the instrumentation that they wish to contribute to the STEREO mission and how it supports the overall mission goals and objectives.

STEREO investigation teams must be led by a single Principal Investigator (PI) who may be from any category of U.S and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies. While this AO is directed primarily toward U.S. Principal Investigator-lead teams with Co-Investigators, proposals for STEREO science investigations will also be considered under a no-exchange-of-funds basis from non-U.S organizations (see Section 5.2) and from investigators proposing Missions of Opportunity (see Section 5.3). Non-U.S. investigations and those on Missions of Opportunity are expected to meet all data policies and program objectives described in this AO, including infusion and transfer of new technology, and enhancing education and public outreach.

## 1.2 NASA Resources Available for STEREO

NASA expects to fund the selected STEREO investigations as the third STP, consistent with the recommendations of the Sun-Earth Connection Advisory Subcommittee (SECAS) and the Space Science Advisory Committee (SSAC). Proposing scientists must recognize that the resources available for participation are cost-capped and propose accordingly. As a guideline, the total value of all investigations selected from study through launch plus thirty days is approximately \$73M in real-year dollars. Of this amount, a total of approximately \$2M is reserved for 3-month, fixed-price Phase A contracts for concept studies. The mission is expected to be launched in approximately June 2004. Confirmation of any selections made from the responses to this AO for final development for flight shall be contingent upon the availability of appropriate NASA funding.

### 1.3 Specific Provisions

This AO solicits scientific investigations from individual Principal Investigators (PI's), aided by a number (see Appendix B, Section C.2.d) of Co-Investigators (Co-I's), for investigations that both provide as well as utilize the data from the proposed hardware. Proposed investigations may provide individual (pairs of) instruments, various combined or teamed instruments, or an entire mission complement of integrated instruments. Multiple (pairs of) instruments proposals must provide technical and cost information for each instrument type sufficient to allow separate evaluation. In addition to U.S. investigators, STEREO proposals are open to non-U.S. investigators, through Memoranda of Understanding, as well as through other Government agencies. Additionally, proposed participation in Missions of Opportunity may be selected if their perceived value is high and the proposed NASA cost is within the funding limits of this mission.

Proposals submitted in response to this AO must be for complete research investigations encompassing all mission phases. For the purposes of this AO, mission phases are defined to be:

Phase A -- concept study; Phase B -- definition and preliminary design; Phase C -- detailed design; Phase D -- development through launch plus 30 days; and Phase E -- mission operations and data analysis. Phase E is to include provision of data for public use, analysis and publication of data in the peer-reviewed scientific literature, and delivery of the data to the appropriate data archive. "Phase E shall also include the full implementation of an approved plan for Education /Public Outreach (see Section 5.5.1 and Appendix E for details)." A Phase F may also be invoked by NASA wherein STEREO would operate in an extended mission mode for collaborative studies with subsequent STP missions such as the Magnetospheric Multiscale and/or Global Electrodynamics. However, such a Phase F is not to be addressed in response to this AO, nor will proposals for only Phase F be considered.

Note that proposals to this AO are expected to be selected through a single-step process in which the final instrument suite is selected prior to the Phase A study. However, NASA reserves the right to make tentative selections pending the outcome of competitive studies through Phase A (see Appendix A, Section II). Confirmations for flight will be made near the end of Phase B based on the information generated during these Phase A and B study periods as documented in the reports from those Phases, and assessed at a Nonadvocacy Review. NASA reserves the right to make partial selections of investigations as described in Section II of Appendix A. The primary discriminator for selection will be based on how well each instrument contributes to the overall scientific objectives as constrained by technical and cost considerations.

Proposers must estimate the Total NASA Cost in their proposals and, if selected through this AO, in much more detail in the Phase A concept study report. The specific cost information required for the current proposals is contained in Appendix B. Since cost details are not anticipated until the conclusion of the concept study, cost estimates in the proposal may be generated with models or cost estimating relationships from analogous investigations. However, during any phase of the investigation except Phase E, the estimated cost to NASA of the total for all investigations must not exceed the NASA cost constraint for this mission. Individual investigations may be descoped to meet cost constraints. Therefore, the proposer shall describe a risk management approach that

identifies a prioritized plan for removal of science objectives along with the estimated cost savings at each step.

The Total NASA Cost is defined as all costs that are necessary to be borne by NASA to complete the proposed investigation beginning with Phase A through Phase E, including reserves. In general, proposers must assume all costs and fees must be included unless specifically excluded by provisions in this AO.

## 2.0 ANNOUNCEMENT OBJECTIVES

NASA announces the opportunity to propose science investigations to be carried into orbit on two STEREO spacecraft in heliocentric orbits at 1 AU, with one spacecraft "ahead" of the Earth and one "behind." The primary objective of this mission is to understand the physical processes involved in the generation of CME's, their evolution in the interplanetary medium, and their coupling with the Earth environment. This understanding will be achieved by observing the 3-D structure and dynamics of CME's; of chromospheric, coronal, and interplanetary plasmas; and of magnetic fields as revealed in both remote sensing as well as in situ data. In order to characterize the relationship between disk-center and off-limb CME observations, special emphasis is placed on observing structures in the corona with a coronagraph whose field of view includes the corona close to the limb of the Sun.

By "observe" is meant acquisition of those data that allow the physical parameters of solar atmospheric disturbances and their coupling to the Earth environment to be quantified. Such data include the timing, size, geometry, mass, speed (as a function of radial distance), and direction of CME's and the plasma properties of the ambient corona-interplanetary medium with adequate spatial and temporal resolution to track the evolution of these disturbances through the interplanetary medium to 1 AU.

By "understand" is meant the interpretation of these data in terms of basic physics, in order to develop dynamical, quantitative, physical descriptions of CME's and the ambient solar corona/heliosphere, descriptions of the processes that generate CME's, and physical insight to space weather with regard to the forecasting of CME's.

Note that the term "instrument" as used in this AO connotes a pair of instruments, one for each of the STEREO spacecraft. Similarly, "multiinstrument" or "suite" connotes at least two pairs of different types of instruments.

A more detailed description of the overall STEREO mission objectives is given in *The Sun and Heliosphere in Three Dimensions, Report of the NASA Science Definition Team for the STEREO Mission*, which may be found on the World Wide Web (WWW) at <http://sd-www.jhuapl.edu/STEREO/report.html>. Proposers unable to access the WWW can request a hard copy of this SDT Report by E-mail to [deb.tripp@hq.nasa.gov](mailto:deb.tripp@hq.nasa.gov).



This study report was produced by a NASA-sponsored group of scientists, and provides background information that may be useful to prospective proposers. In case of a conflict between concepts outlined in this AO and those in the Science Definition Team report, the provisions of this AO take precedence. In particular, to be considered responsive to this Announcement, proposed investigations must address the objectives described in this section (Section 2.0).

In addition, the NASA Office of Space Science has developed a comprehensive approach for making education at all levels (with a particular emphasis on pre-college education) and the enhancement of public understanding of space science integral parts of all of its missions and research programs. Appendix E of this AO provides further details about the requirement for appropriate Education/Public Outreach proposals to this AO.

### 3.0 BACKGROUND

NASA's Sun-Earth Connection program is designed to better understand the origins of solar variability, how that variability transforms the interplanetary medium, how it impacts the Earth's space environment, and how it might affect life and climate on Earth.

#### 3.1 Previous Solar Missions

For many years space scientists have recognized that the Sun possesses an extended atmosphere within which the Earth, planets, and other bodies reside. This "solar wind" or outflow of plasma, energetic particles, and magnetic fields represents the extension of the Sun's lower atmosphere, the corona, into interplanetary space. The quiescent coronal features are marked by dynamic transient events, called coronal mass ejections (CME's), starting low in the corona and propagating outward to affect the entire heliosphere. However, the direct connection between short-lived activity near the Sun as observed remotely and the in situ observations of solar wind characteristics and disturbances of the Earth's magnetic field, as measured directly, has remained a difficult problem to reconcile.

During the past decade a new outline in the Sun-Earth Connection framework has begun to be revealed. The importance of the transient ejection of material and magnetic fields from the Sun's atmosphere has been recognized as the dominant cause of the most severe geomagnetic storms. These CME's have also been associated with the generation of energetic particles that can pose a threat to technology both in orbit and on the ground and also to human spaceflight. CME's have now been observed for several decades by ground-based and space-based platforms, but the limitation of these observations, which are restricted to the Sun-Earth line, has made the reliable detection and characterization of solar events directed toward the Earth a difficult to impossible task. Moreover, the necessary physical conditions leading to the generation of a CME and the ejection of significant amounts of plasma and magnetic field from the gravitational potential of the Sun remain a mystery.

Direct observation of the ejection of these huge structures at the Sun has been accomplished remotely by coronagraphs on the ground (Mauna Loa Solar Observatory) and on space-based platforms (Orbiting Solar Observatory, Skylab, Solar Maximum Mission, Solwind, Spartan, and

Solar and Heliospheric Observatory) that imaged the Thomson-scattered photospheric radiation from electrons in the corona from about 1.5 to as far as 30 Rs from Sun center (where Rs is the radius of the Sun). However, coronagraphs can only produce images of coronal features and CME's against the plane of the sky. Hence, from observations acquired by coronagraphs in low Earth orbit or at the L<sub>1</sub> Lagrangian Point, it is impossible to determine:

- (1) if a CME will impact the Earth,
  - dependent on the 3-D directionality of the CME and,
  - dependent on the 3-D structure of the CME, or
- (2) when a CME will strike the Earth,
  - dependent on the transit speed of the CME.

If complementary observations from the chromosphere or inner corona are available, then occasionally a rough guess about the direction of the CME with respect to the Earth can be made, for example, for so-called "halo" events. But the remaining questions above cannot be resolved by additional observations from low Earth orbit or from L<sub>1</sub> alone. Finally, observations of radio signals produced by particle acceleration in coronal and interplanetary magnetohydrodynamic shocks have been associated with CME's. But these observations also have not yet proven reliable as a means to track the passage of these structures through interplanetary space. Thus, there is only one way to determine reliably the occurrence and the characteristics of Earthward-directed CME's, namely, through observations of these events obtained from multiple vantage points located sufficiently far from the Sun-Earth line. This is the observational approach of the STEREO mission. Planning for the STEREO mission has focused on the development of a payload consisting of a complement of instruments capable of returning these observations.

### 3.2 Solar-Terrestrial Probes

NASA's Sun-Earth Connection program intends to improve humankind's understanding of the origins of solar variability, how that variability transforms the interplanetary medium, how eruptive events on the Sun impact geospace, and how they might affect life and climate. STEREO is the third of five Solar-Terrestrial Probes called for in NASA's Space Science Enterprise Strategic Plan to accomplish the goals of the Sun-Earth Connection program. The first of these missions, the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics mission (TIMED), is scheduled for launch in 2000. The other future missions are:

- *Solar-B*, sponsored by Japan with the participation of NASA, which will obtain high-resolution detail of the solar magnetic field to determine how it emerges and evolves at the solar surface and couples with the processes occurring in the corona;

- *Magnetospheric Multiscale*, which uses a set of up to six small satellites to investigate the magnetospheric response to solar mass ejections, fundamental boundary processes driving macroscales, and processes of energetic particle acceleration and magnetic reconnection; and
- *Global Electrodynamics*, which uses a set of approximately four small satellites to probe the electromagnetic coupling between the Sun, magnetosphere, and upper atmosphere.

While these missions individually will doubtless produce exciting discoveries about the complex Sun–Earth system, together they are a formidable fleet that will greatly improve the ability to predict weather in space, enhance knowledge of solar influences on climate change, and give fresh insight into the origins and future of life on Earth. Although the Sun is much quieter today than in the distant past—it was once a rapidly rotating, strongly magnetic, violently active star with a massive stellar wind—it is still capable of violent explosions and substantial variations in radiative output. Understanding presentday solar activity will help humankind understand the history of the Sun’s climate and its possible influence on Earth’s evolution and the development of life in the Solar System.

### 3.3 Programmatic Recommendations to NASA

The ability of NASA space missions to study the launch of solar disturbances and their impact on geospace is a recent development. However, the physical processes leading to these eruptive phenomenon have been of great importance to the U.S. solar space program ever since their discovery in 1973 by instruments on NASA’s Skylab/Apollo Telescope Mount. The report of the *National Space Weather Program Strategic Plan* (FCM-P30-1995) explicitly recommended flight of a suite of instruments at different vantage points to provide necessary observations that will allow the understanding and prediction of the space environment. Subsequently, the *Space Science Enterprise Strategic Plan* (1997) (see: <<http://spacescience.nasa.gov/strategy/1997/>>) advocated the STEREO mission for breakthrough science and progress toward reliable space weather forecasts.

In particular, two spacecraft at 1 AU, one drifting well ahead of Earth and one well behind, will serve the objectives of NASA’s Sun-Earth Connection theme by (1) enabling fundamental research on the three-dimensional structure and dynamical processes of CME’s, (2) providing comprehensive measurements of the interplanetary environment in support of follow-on Solar-Terrestrial Probes, and (3) providing the science base for greatly improved forecasts of Sun-driven disturbances at Earth. The two viewing angles will largely remove the current uncertainty that exists in predicting Earth-directed CME’s. Given this background, the NASA STEREO mission was specifically endorsed by the Sun-Earth Connection Advisory Subcommittee in April 1997 and the Space Science Advisory Committee (see Appendix C) in May 1997.

## 4.0 PROPOSAL OPPORTUNITY PERIOD

The schedule of events associated with this Announcement of Opportunity is as follows:

Release AO and Model Phase A Contract	April 28, 1999
Notice of Intent due (see Section 6.1)	May 28, 1999
Proposal submittal due by 4:30 pm EDT	July 28, 1999
Non-U.S. Letter(s) of endorsement due	August 27, 1999
Selection of investigations for Phase A Study (goal)	October 28, 1999
Award of Phase A Study Contracts (goal)	November 29, 1999

## 5.0 REQUIREMENTS AND CONSTRAINTS

### 5.1 Description of the STEREO Mission

#### *5.1.1 Candidate Instruments for the Model Payload*

In order to give prospective proposers the fullest possible understanding of the STEREO mission, NASA provides the following description of a candidate payload (identical on each spacecraft) based on the SDT report. The instrument descriptions here are not intended in any way to restrict the possible approaches, nor is the list intended to preclude consideration of other instruments or combinations of instruments. The list is simply a description of a sample instrument complement that can meet the mission science objectives. At the time of the writing of this AO, the interfaces and performance envelopes indicated here are preliminary. Any significant variations on these specifications will be posted directly following this AO on the NASA Research Opportunities WWW page at <<http://www.hq.nasa.gov/office/oss/research.htm>>. Any amended interface and performance specifications provided at the above WWW site will be the ones against which proposals will be judged for evaluation purposes. If an interface or resource is not addressed in that WWW site, then the specifications in this AO will be used for evaluation purposes.

Furthermore, proposers must be aware that, if they are selected, they may be asked to revise their proposed hardware as needed to meet slightly different spacecraft and mission requirements and specifications. Distinct from information provided in this AO and on the above NASA Headquarters WWW site, nonofficial discussions of the spacecraft and mission architecture may be viewed at the WWW page at <<http://sd-www.jhuapl.edu/STEREO/>>.

#### Chromosphere and Inner Corona Imager

This telescope should be able to obtain full-Sun images in at least one coronal and one chromospheric emission line. The images should show solar prominences and coronal loops and other coronal structures from the base of the corona to 1.5 Rs (radii from Sun center). It is desirable for the Chromosphere and Inner Corona Imager (CICI) to include fast time cadence capability and spectral scanning capability so that Doppler shifts can be measured. The nominal spacecraft resource allocations for the CICI are given in Table 5-1 (see Section 5.1.3 below).

### Coronagraph

The white light coronagraph should be capable of observing the white light corona with high sensitivity, spatial resolution, and time resolution from  $\sim 1.1$  Rs to  $\sim 5$  Rs in order to provide a reasonable region of overlap of the coronal structures observed in the chromosphere and inner coronal imager. A substantially larger field of view is also important for studying the 3-D structure of streamers, the evolution and acceleration of streamer blowoffs, and the acceleration of inhomogeneities in the solar wind. Aspects of the coronagraph design peculiar to the specific objectives and mission architecture of STEREO must be carefully considered. For example, two coronagraphs will be working together at different ecliptic longitudes with dissimilar F-corona backgrounds and at different distances from the Sun. Also, a region of interest on the Sun will likely have dissimilar foreshortening due to the separation angle of the two spacecraft. The nominal spacecraft resource allocations for the coronagraph are given in Table 5-1 (see Section 5.1.3 below). Spacecraft pointing and stability is discussed in Section 5.1.2.

### Radio Burst Tracker

STEREO spacecraft are expected to carry a radio receiver so that triangulation of solar transient events can allow routine tracking of radio disturbances accurately (to within  $\pm 1$  deg) from about 1–2 Rs to 215 Rs, with a corresponding radio frequency range of  $\sim 15$  MHz to  $\sim 30$  kHz. A time resolution of a few seconds is desirable. The deployment mechanism for the antenna(e) shall be provided by the proposer. Resource allocations for this instrument are provided in Table 5-1 (see Section 5.1.3 below).

### Heliosphere Imager

The heliosphere imager should have spatial resolution of  $\sim 1$  deg on the plane of the sky and a cadence of about one image per hour from each STEREO spacecraft. The imager should have high signal to noise and should be designed with a wavelength band and field of view allowing mapping of the solar wind and CME's at heliospheric distances between about 30 Rs and 215 Rs. Nominal spacecraft resource allocations for the heliospheric imager are given in Table 5-1 (see Section 5.1.3 below).

### Solar Wind Plasma Analyzer

The solar wind plasma analyzer should measure the distribution functions of ions and electrons over the energy ranges of 300–8000 eV for positive ions and 1–1000 eV for electrons to provide density, velocity, temperature, and anisotropy. The required time resolution is a few minutes. Nominal spacecraft resource allocations for the solar wind plasma analyzer are given in Table 5-1 (see Section 5.1.3 below).

## Magnetometer

STEREO in situ magnetic field measurements should achieve a dynamic range of at least  $\pm 50,000$  nT with a resolution of 0.2 nT in one channel, and  $\pm 500$  nT with a resolution of 0.002 nT in a second channel. A few vector field measurements per second should be sufficient for the STEREO mission. The magnetometer will be mounted on a project-supplied boom that must not interfere with optical instrument fields of view. Nominal spacecraft resource allocations for the magnetometer are given in Table 5-1 (see Section 5.1.3 below).

## Solar Energetic Particle Detector

Only rather modest instrumentation based on proven approaches is required to address the mission objectives for energetic particle detection, that is, understanding the mechanism for the production of CME shock-accelerated particles. The solar energetic particle detector (SEPD) should be able to distinguish impulsive from gradual events, where gradual events are characterized by being enriched in  $\text{He}^3$ , electrons, and heavy ions, and by having a faster than normal rise and decay. The SEPD should perform in situ sampling with one minute time resolution. It should be able to measure the absolute intensity and energy spectra of energetic electrons from about 0.1 to 3 MeV, of protons from about 0.1 to 100 MeV, of helium ions from about 1 to 100 MeV/nuc, and of heavy ions ( $6 < Z < 28$ ) from about 2 to 30 MeV/nuc. It should be able to identify the presence of  $\text{He}^3$ . Nominal spacecraft resource allocations for the SEPD are given in Table 5-1 (see Section 5.1.3 below).

### *5.1.2 Description of the NASA-Provided Spacecraft*

The baseline STEREO mission will consist of two identically-instrumented, 3-axis stabilized, Sun-pointed spacecraft placed in slowly drifting heliocentric orbits. One spacecraft will be placed in a trajectory leading the Earth and the other in a trajectory lagging the Earth. The first spacecraft will drift away from the Earth at 15 deg per year and the second spacecraft at 30 deg per year. Although the spacecraft may be launched together, current plans are to launch them separately within a two-month interval. The launch vehicle has not yet been selected.

The underlying philosophy of the spacecraft design is to decouple the instrument and spacecraft functions as much as possible in order to achieve efficiencies in development and integration. Therefore, the spacecraft bus-to-instrument interfaces are kept as simple as possible. The spacecraft has no role in instrument commands, telemetry, or operations. Communication services are expected to consist of a “bent-pipe” relay of commands and telemetry to and from the instruments, with no data processing provided by the spacecraft bus or by the mission operations center. The spacecraft will provide a common set of interfaces to each of the instruments. Any proposed additional interfaces will require careful and full justification during Phases A and B.

Since reliability is important for this mission, proposers should pay careful attention to robust design which should include consideration of redundancy for key elements of the hardware. A safety program appropriate for a payload on an expendable launch vehicle will be required. For pricing purposes, the proposers should assume a flexible Grade 2 or Class B parts program (per MIL-STD 975). Detailed plans for the assurance and reliability program will be developed during Phases A and B.

## Spacecraft/Instrument Interfaces

The standard interfaces between the spacecraft and the instruments consist of the following:

- Main power (22-35 volts) to the instruments
- Survival heater power (22-35 volts) to the instruments
- MIL-STD 1553B data bus (bidirectional)
- Pointing error signal (2 axes) back to the spacecraft
- RS-422 data link back to the spacecraft
- Temperature monitors (2) back to the spacecraft

Other than the signals listed above, no individual discrete or analog interfaces connect the spacecraft and the instruments. The only reset to the instrument electronics occurs via a "power-on" command. Note that the spacecraft will accept pointing errors from only one instrument, which is the Chromosphere and Inner Corona Imager. Likewise, only a single RS-422 interface is available. All data communication between the spacecraft and the instruments occurs via the MIL-STD 1553B data bus and the RS-422 link. However, instruments with existing data interfaces that are incompatible with the MIL-STD 1553 may be proposed but must include costs to convert the instrument to these standards. The spacecraft can provide an Instrument Data Processing Unit (IDPU) to be shared by a limited number of instruments. Note that the cost of the IDPU will be deducted from the funding resources available for the instruments. Future references to the spacecraft/instrument bus interface will assume the presence of a 1553 interface, either via the instrument itself, or via the IDPU. Any revised information concerning interfaces will be available at the WWW location where this AO is posted.

## Electrical Interfaces

The spacecraft will supply each instrument with unregulated +28 volt DC power from two separate spacecraft power busses: the main power bus and the survival heater power bus. The spacecraft will maintain the voltage on each bus between 22 and 35 volts DC.

The spacecraft will control the main bus power relays for each instrument, and each of these circuits will be individually fused in the spacecraft. The instruments will use this power for all their internal electronics, including any operational heaters. Power from the survival power bus will be available continuously throughout the mission, to be used solely by survival heaters controlled by passive thermostats with fixed set points. Instrument teams will be able to specify placement of heaters and thermostats as well as select set points for thermostats. The total aggregate power available to the instrument complement is 61.8 watts, which includes a 20% margin.

## Bus Architecture

A MIL-STD 1553B data bus is the primary method for command and telemetry transfers between the spacecraft and the instruments. However, if a high data rate requirement prevents it from transmitting telemetry via the 1553, one instrument may transmit high rate data to the spacecraft via a dedicated RS-422 link.

The spacecraft computer controls all spacecraft operations. With respect to the spacecraft-to-instrument interfaces, the spacecraft computer provides instrument commands, collects, and stores telemetry and distributes time. On the 1553 communication bus, the spacecraft computer always acts as bus controller, while the instrument computer interface(s) are the remote terminals.

## Cold-Gas Propulsion System

The spacecraft will have a cold-gas propulsion system for momentum management; thruster firings are nominally planned once every four days. Instruments needing contamination protection from this system must provide their own protective mechanisms. Thruster firings may cause pointing perturbations on the order of 0.25 degrees. The spacecraft will provide a warning to all instruments via the 1553 bus prior to firings.

## Pointing Knowledge and Pointing Control

There are three reaction wheels, one for each axis, with an option of a fourth one for axis redundancy. In order to achieve the tight pointing requirements for imaging, the coronagraph will need to provide the spacecraft control system with pointing error signals in two independent axes. It may provide the pointing error signal to the spacecraft as high resolution analog signals or as a MIL-STD 1553B bus data packet. Emphasis should be placed on minimizing latency in the pointing error signal; therefore, the preferred signal type is analog.

For planning purposes, the pointing error signal has been assumed to be accurate to 0.1 arcsec (3 sigma) and supplied at 10 Hz. The coronagraph will set the control and knowledge requirements for the entire spacecraft. These requirements are estimated to be:

Knowledge	Roll	60 arcsec
	Pitch	0.1 arcsec
	Yaw	0.1 arcsec
Control	Roll	0.1 degree
	Pitch	20 arcsec
	Yaw	20 arcsec

Pointing control of other instruments will be essentially the same as for the coronagraph, except for low frequency jitter which may be controlled by internal optics, if required. Knowledge for the other instruments will differ from the coronagraph mainly by misalignment errors as hardmounted to the spacecraft.



## Alignment

Co-alignment of instruments to the coronagraph should be assumed to be 0.1 deg, knowledge and stability, in all three axes. Instruments requiring prelaunch alignment must provide an optical cube mounted to the outside of the instrument that is mapped to instrument coordinates. Instruments that need better alignment must provide their own methods of adjustment or correction through physical vernier adjustment or data calibration (i.e., observations and/or software).

## Jitter

The jitter requirement is driven by the CICI performance. The total observatory jitter specification is:

Roll	30 arcsec RMS
Pitch/Yaw (3 sigma)	1.5 arcsec (0.1 to 1 Hz)

To meet the jitter requirement, the control bandwidth (BW) of the system must be as high as possible consistent with the baseline design of the spacecraft and instruments and nominal pointing requirements. The goal for BW will be 0.1 Hz; however, for proposal purposes, the BW should be assumed to be in the 0.03 to 0.1 Hz range.

Because it will be extremely difficult for the spacecraft bus to accommodate the entire jitter budget, CICI proposers should assume that an image compensation system of some kind will be required internal to their instrument. This issue will be studied in detail during Phases A and B.

Instrument booms/antennae must have as much inherent damping of bending modes as possible. If the booms have bending frequencies less than the BW, the spacecraft control system should be able to control, or at least limit them. Frequencies higher than the BW will contribute to jitter for all instruments, if excited at that frequency. In general, stiff booms are mandatory because of the response rolloff with frequency.

### *5.1.3 Instrument Accommodation*

The shared 1553 data bus provides data interfaces between the spacecraft and instruments. The spacecraft acts as the bus controller and each instrument is a remote terminal. Data transfers may be packetized or unpacketized. Packetized transfers are formatted using the Consultative Committee for Space Data Systems (CCSDS) packet protocol, whereas unpacketized transfers have variable lengths and formats.

The spacecraft will support uplink rates at 125 bits/sec (normal) and 7 bits/sec (emergency). In normal operations, the spacecraft accepts commands at the normal rate concurrent with telemetry downlink. Due to this relatively low command uplink rate, teams must design their instruments to require only a small number of commands per day.

The spacecraft will send command packets to the instruments without processing. It is the responsibility of each instrument team to define the formats of the data portions of its command packets. The spacecraft will not generate instrument commands autonomously.

The spacecraft will support storage of command packets for distribution to instruments at a later time. The aggregate size of memory available to all instruments for stored commands is approximately 200 kilobytes. Stored command packets may be individually time tagged with one second precision, or may be part of a macro sequence.

An unpacketized broadcast message to all instruments will be distributed once per second. This message will contain:

- Time
- Warning flags for
  - Sun keep-in violation
  - Thruster firing
  - Instrument power-off
  - Indication that next housekeeping data set will be downlinked or recorded
- Spacecraft housekeeping data required for instrument science

The spacecraft will collect data from the instruments via the 1553 (and science packets from RS-422 high speed link, if required) according to a fixed schedule. Data can be stored on an on-board 8 gigabit recorder. The instruments must generate each science packet according to the full CCSDS telemetry packet format, including primary and secondary headers, checksum, etc. The maximum aggregate data collection rate for science packets from all instruments will be 408 kbps.

The spacecraft will not process instrument data before recording or downlink. Any processing or data compression is the responsibility of the instrument. The instruments will have no direct access to the onboard recorder and will not be able to retrieve data on-board.

Housekeeping data will be collected every second. The spacecraft will perform very rudimentary monitoring of this data strictly for fault protection. For example, one bit in the packet will be designated as a request by the instrument for the spacecraft to turn off its power. Other than this monitoring, the instruments must not depend on the spacecraft to perform processing of housekeeping data. Each instrument must include housekeeping data in its own science packets if needed for science evaluation.

A small amount of unpacketized “space weather” data from each instrument will also be collected every second to support a space weather broadcast mode similar to that employed by the Advanced Composition Explorer mission.

## Thermal Interfaces

It is highly desirable for each instrument to be thermally isolated from the spacecraft. It is, however, recognized that for passive cooling of detectors, it may be appropriate for the spacecraft to provide the necessary radiators. Thermal analysis/modeling for an instrument must be provided by the PI team. Any need for thermal coupling to the spacecraft must be fully described in the proposal.

## Summary

Although the spacecraft design is still preliminary, the total resources that are estimated to be available for each of the scientific instruments are summarized in Table 5-1. Updated information will be made available if needed at the same WWW location where this AO is posted. Proposers unable to access the WWW can request a hard copy of these reports by E-mail request to [deb.tripp@hq.nasa.gov](mailto:deb.tripp@hq.nasa.gov).

Table 5-1. Nominal Instrument Resource Allocations per Spacecraft

Component	Number	Mass Total (kgs)	Size (cm)	Power Total (watts)	Data Rate Available (bps)
Solar Energetic Particle Detector	1	3	25 x 18 x 12	2.0	200
Heliospheric Imager	1	6.8	20 x 20 x 12	20.0	$7 \times 10^3$
Magnetometer				2.0	200
Sensor	1	0.3	5 x 5 x 10		
Electronic Box	1	1.7	20 x 15 x 8		
Radio Burst Tracker				4.0	200
Antenna	3	1	1000 length x 1.27 dia.		
Deployment Mechanism	3	3.3	14 x 9 x 26		
Electronics	1	4	20 x 10 x 3		
Chromosphere and Inner Corona Imager	1	15	5 x 10 x 150	10	$350 \times 10^3$
Coronagraph	1	15	6 x 6 x 150	10	$50 \times 10^3$
Solar Wind Plasma Analyzer	4	7		3.5	200
Totals		57.1		51.5	

The power allocation for each instrument includes the total available power for operational heaters of each individual instrument. The mass and power allocations listed in Table 5-1 do not include margins. For the purposes of this AO, a 20% margin on the total instrument allotment is held at the Project level. Margin allocations to individual instruments will be made after instrument selection. However, proposers must include additional instrument-level reserve within their proposal. The definitions of margin and reserve are given in Appendix B (Section C), together with examples.

#### *5.1.4 Mission Operations Support*

STEREO mission operations are designed to support the spacecraft integration and testing, launch preparation, early orbit checkout, and the entire mission life. The mission operations center has responsibility for the control, commanding, telemetry download distribution, and health and safety checkout of the STEREO spacecraft. The science operations center will provide scientific observations planning, generate instrument command timelines, and perform science data analysis. The science operation center is solely responsible for the health and safety of the STEREO instruments. Proposers are reminded to include the cost of instrument health and safety oversight during the mission phase. Details of the STEREO science operations will be defined by the selected science teams.

The baseline plan is to have one daily 8-hour Deep Space Network (DSN) contact per spacecraft. During this time, the spacecraft playback high rate data will be downloaded, as well as real time and housekeeping data. Instrument commands will be received by the mission operations center, which will manage the spacecraft and instrument uplink loads for transmission to the spacecraft. A one-hour period within the daily pass will be allocated for commanding. The mission is being designed to implement autonomous operations, such as unattended spacecraft contacts and the use of automated paging to achieve better management of spacecraft anomalies. The mission operations center shall be capable of scheduling and supporting emergency DSN contacts to mitigate spacecraft or space weather emergencies.

#### *5.1.5 Project Schedule*

The STEREO mission of NASA-provided spacecraft will be launched approximately June 2004. In order to satisfy this schedule, the instruments will be required by March 2003 for integration and testing. Proposals must clearly identify sufficient reserves (both schedule and financial) to ensure on-time delivery of the instruments. The baseline STEREO mission duration is two years. After this period, a Phase F may be invoked wherein the STEREO spacecraft are utilized to provide service for STP missions that follow STEREO. Proposals to this AO should ignore the possibility of a Phase F. The Project Schedule, as currently established, is summarized in Table 5-2.

Table 5-2. Schedule for Two-Spacecraft STEREO Launch in 2004

Phase A	October 1999
Phase B	January-November 2000
Preliminary Design Review/ Nonadvocacy Review	July 2000
Investigators confirmed for flight	August 2000
Phase C/D	October 2000-July 2004
Critical Design Review	March 2001
Flight Model delivery	March 2003
Launch	Approximately June 2004
Phase E	July 2004-June 2006
Phase F (Not covered by this AO)	June 2006-May 2009

## 5.2 International Participation

Recognizing the potential scientific, technical, and financial benefits offered to all partners by international cooperation, participation by non-U.S. organizations in STEREO investigations is welcomed. Such participation may include, but is not limited to, the contribution of the investigation and requisite scientific instruments, the spacecraft (or a portion thereof), and the subsequent sharing of the data from the mission, all on a no-exchange-of-funds basis. Such contributions are not accounted against the mission cap. Carriers, launch vehicles and launch services, and space operations may also be contributed by international partners and should be included in all calculations and discussions of the total cost of the investigation which is the sum of the cost to NASA and the cost of the contributions (see section 7.1 and Appendix B, Section F).

The direct purchase of goods and/or services from non-U.S. sources is permitted except that NASA is precluded from purchasing non-U.S. launch vehicles, nor may funds provided to a mission team be used to purchase a launch vehicle from a non-U.S. source. The provision of launch services as a contribution to the STEREO mission by a non-U.S. partner is acceptable only on a no-exchange-of-funds basis (i.e., at no cost to NASA). Only those non-U.S. launch vehicles with demonstrated reliabilities may be proposed for the STEREO mission.

Participation by non-U.S. institutions in STEREO investigations must be endorsed by the governments involved, if government support is required. The letter of endorsement must provide evidence that the non-U.S. institution and/or government officials are aware and supportive of the proposed investigation and will pursue funding for the investigation if selected by NASA. Such endorsements must be submitted as per the schedule in Section 4.0.

### 5.3 Missions of Opportunity

For Missions of Opportunity, the U.S. proposer offers to participate in a mission not sponsored By the NASA Office of Space Science (non-NASA OSS mission) that is planned or that has been approved by its sponsoring organization. NASA would fund provision of an investigation on a non-NASA OSS spacecraft if that instrument could be regarded as part of the STEREO mission or could otherwise significantly augment the STEREO mission. The proposed investigation must address the science objectives summarized in Section 2.0. The participation in the non-NASA OSS mission could take many forms, such as providing a complete science investigation, hardware components of a science instrument, or expertise in critical areas of the mission. NASA will evaluate the proposed investigation, not the sponsor's entire mission. While the investigator is not required to document the entire mission of the sponsor, the U.S. investigator must fully document their complete investigation in the proposal. Sufficient information about the Mission of Opportunity must be provided to enable NASA to assess the performance, schedule, and cost risk associated with the non-NASA OSS mission.

A Mission of Opportunity may be sponsored by a non-U.S. government organization or by a U.S. agency or non-NASA OSS. Mission of Opportunity investigations on a military satellite are allowed as long as the satellite is not planned for weapons testing.

Note that selection by NASA through this AO does not constitute selection of the investigation as part of the mission, which necessarily is a decision made by the sponsor of the mission. Instead, selection is a commitment by NASA to fund the U.S. portion of the investigation as part of the STEREO program (and thus within the STEREO cost cap), although funding beyond basic studies does not begin until detailed design of the mission itself is underway. If an investigation is selected both by NASA and by the mission sponsor, the PI is responsible to NASA for the scientific integrity and the management of the PI's contribution to the mission.

A Confirmation Review will be held prior to the start of Phase C/D. Assuming a positive outcome, NASA will confirm the investigation to proceed to development. Mission of Opportunity investigation teams will have data analysis responsibilities defined by the policies of the mission sponsor; nevertheless, as a condition for confirmation, NASA expects that the mission sponsor will enter into an agreement with NASA to assure that data returned from at least those aspects of the mission in which NASA support is involved, if not the entire mission, will be made available to the U.S. scientific community in conformance with the STEREO data policies.

Missions of Opportunity are conducted on a no-exchange-of-funds basis between NASA OSS or other parts of NASA and the mission sponsor. A Mission of Opportunity investigation that is submitted under this AO will be subject to the same selection and review process and will require commitment by the PI for the same cost, schedule (subject to negotiations), and scientific performance as an investigation selected under the NASA-provided spacecraft option. In addition, in keeping with OSS policy, proposals for a Mission of Opportunity to this AO must also include an Education/Public Outreach proposal (see Section 5.5.1 and Appendix E for details).

It is incumbent on the proposing investigator to provide evidence in their proposal that the sponsoring organization intends to fund the mission and state when the endorsement of NASA for U.S. participation is required. The launch date or date(s) must be no later than the end of FY 2004. The operational phase of a Mission of Opportunity must include a reasonable overlap with the planned STEREO baseline mission operation phase.

Like other investigations proposed to this AO, the NASA funding is subject to cancellation if there is a cost overrun charged to NASA for any reason, including a launch delay caused by the non-NASA OSS partner. The PI assumes all risk for delays in the mission and must propose appropriate reserves. The specific cost information required for proposals is contained in Appendix B.

#### 5.4 STEREO Data Policy

The STEREO science goal is that the totality of the anticipated data be brought to bear on the phenomena observed in a coordinated way in order that significant progress can be achieved. The data will be treated as a public resource and will be made available for public access as soon as is practical. With that in mind, the following principles will guide the development of the final data policy:

- (1) In accordance with solar physics open data and software tradition, after the initial check out and calibration period (approximately 3 months), the STEREO database and requisite basic analysis software will be made available to the international community through a NASA data center. From that time, data shall be made public with no more than a two-month delay. Once the calibrated STEREO data are deposited in an accessible data bank, it is the intention of NASA to provide support for extended data analysis through a Guest Investigator (GI) Program
- (2) In general, encouragement will be given to STEREO mission data being treated as a whole so that scientific topics may be studied to the maximum extent allowed by the totality of the available observations.
- (3) The participation of investigation teams is expected to continue for some time post launch to expedite data analysis. Investigators are expected to provide training materials for the flight operations team and any specialized software required for basic analysis of data by the community.
- (4) The investigators will determine scheduling of instrument operating sequences, which is expected to be required daily. Proposers must identify how they plan to satisfy this requirement from the standpoint of hardware, software, and personnel.

- (5) The location of the data analysis center(s) will be determined by the PI teams and NASA during the study phases.
- (6) A small amount of unpackitized “space weather” data from each instrument will be collected every second, in support of a space weather broadcast mode similar to that employed by the ACE mission.

#### 5.5 Education, Outreach, New Technology, Small Disadvantaged Business Requirements, and Minority Institution Requirements

##### 5.5.1 *Education and Public Outreach (E/PO)*

Proposers to this AO are required to include an E/PO plan as part of the overall proposal. See Appendix E for a detailed discussion of the E/PO program and the evaluation criteria for E/PO proposals. Appendix E also provides information on NASA-funded assistance available to develop E/PO proposals.

##### 5.5.2 *Advanced Technology*

NASA seeks to infuse new technologies that enhance performance and reduce costs into its programs and to strengthen the mechanisms by which it transfers such technologies to the private sector, including the nonaerospace sector. The means by which NASA’s Office of Space Science plans to implement new technology is described in the *Office of Space Science Integrated Technology Strategy*, which is available via the internet at [http://www.hq.nasa.gov/office/oss/policy\\_pub.htm](http://www.hq.nasa.gov/office/oss/policy_pub.htm). Investigations dependent on new technology will not be penalized for risk provided that adequate plans are described to provide a reasonable back-up approach that will assure the success of the investigation.

##### 5.5.3 *Small Disadvantaged Businesses and Minority Institutions*

The PI and team members shall agree to use their best efforts to assist NASA in achieving its goal for the participation of small disadvantaged businesses, women-owned small businesses, Historically Black Colleges and Universities, and other Minority Educational Institutions in NASA procurements. Investment in these organizations reflects NASA’s commitment to increase the participation of minority concerns in the aerospace community, and is to be viewed as an investment in our future. Offerors, other than small business concerns, are also advised that contracts resulting from this AO will be required to contain a subcontracting plan that includes goals for subcontracting with small, small disadvantaged, and women-owned small business concerns. (See Appendix A, Section XI.)



## 6.0 PROPOSAL SUBMISSION INFORMATION

### 6.1 Preproposal Activities and Notice of Intent to Propose

Technical questions concerning this AO may be directed to the NASA Headquarters STEREO Program Scientist :

Dr. Madhulika Guhathakurta  
Research Program Management Division  
Code SR  
Office of Space Science  
NASA Headquarters  
Washington, DC 20546-0001  
Telephone: 202-358-1992  
Fax: 202-358-3097  
E-mail: lika@tristang.gsfc.nasa.gov

In order to inform prospective proposers of any significant changes in the STEREO project, especially concerning the resources likely to be available for the payload, plans for mission development, operations, data analysis, and expected Project schedule information will be posted at the same WWW site as this AO. Also, questions may be submitted by prospective proposers by letter or E-mail to the STEREO Program Scientist (listed above), and may cover any phase of the STEREO program. All questions and answers will be posted at the same WWW site as this AO. The author(s) of such questions will not be identified. It shall be understood by prospective proposers that, while every effort will be made to ensure that such information will be as current as possible, many of the final STEREO specifications will not be determined until the payload instruments are actually chosen and the mission science team is established and functioning.

A Notice of Intent (NOI) to propose should be submitted by each prospective Principal Investigator on or before the deadline given in Section 4.0. The NOI requests information, to the extent known, on the objectives of the proposed investigation, including a description of the instrumentation to be proposed. The NOI should also include the names, addresses, telephone numbers, and E-mail addresses of all prospective team members and their sponsoring organizations. It must be emphasized that STEREO is a cost-capped mission. Hence, science team size must be minimized as much as practical (see Appendix B, section C). All material provided to NASA through an NOI is for information only and is not binding on the submitter. An NOI is not required but is strongly encouraged by NASA in order to assist in the planning of the evaluation of proposals.

An NOI to propose should be submitted via the Internet site at <<http://props.oss.hq.nasa.gov/>>. If you have any problems submitting the NOI please contact Ms. Debra Tripp at E-mail: [dtripp@hq.nasa.gov](mailto:dtripp@hq.nasa.gov); fax: 202-554-3042. Do not send a duplicate NOI, by postal mail.

## 6.2 Format and Content of Proposals

Certain key NASA policies for proposals in general are given in Appendix A, which are binding. A uniform proposal format, which is summarized in Appendix B, is required from all proposers to aid in proposal evaluation for both STEREO science investigations and Missions of Opportunity. Failure to follow this outline may result in reduced ratings during the evaluation process, or in extreme cases, could lead to rejection of the proposal without review. The proposal shall be limited to a single volume plus the prefatory materials and the allowed appendices (see Appendix B). The volume must provide a clear statement of the proposed research investigation and how it will address the scientific objectives of the STEREO mission (as outlined in Section 2.0), while maintaining consistency with the NASA resources (Section 1.2), expected model payload and spacecraft, the missions operations and data analysis plans, and the expected Project schedule (Table 5.4). The proposal must contain enough background information to be meaningful to a reviewer who is generally familiar with the field, although not necessarily a specialist. Finally, all proposals to this AO must contain an Education/Public Outreach proposal submitted in compliance with Appendix E.

The description of proposed hardware must provide adequate technical information to permit evaluation. Proposals for multiple instruments are expected to justify each instrument type. Multiple-instrument proposals are expected to provide technical and cost information for each instrument type sufficient to allow separate evaluation.

## 6.3 Submission Information and Certifications

### 6.3.1 *General*

All proposals must have a Cover Page and Proposal Summary that is to be submitted electronically at the Web site given in Appendix B. Once the form is submitted, it must be printed and used to obtain the required Principal Investigator and institutional signatures. Paper copies of proposals and the original, signed version must be received by the indicated due date.

Unlike previous NASA solicitations, the authorizing institutional signature on the printout of the electronically submitted cover now also certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix D. Therefore, it is not necessary to separately submit these certifications with the proposal.

Proposers must provide 40 copies of their proposal, plus the original signed proposal. All proposals must be received at the following address by 4:30 pm EDT on the proposal deadline date given in Section 4.0:

STEREO Support Office  
Jorge Scientific Corporation  
Suite 700  
400 Virginia Avenue SW  
Washington, DC 20024

Point of contact for commercial delivery: Ms. Debra Tripp at 202-554-2775. All proposals received after the closing date will be treated in accordance with NASA's provisions for late proposals (Appendix A, Section VI).

NASA will notify the proposers in writing that their proposals have been received. Proposers not receiving this confirmation within two weeks of the proposal deadline should contact Dr. Madhulika Guhathakurta at the address shown in Section 6.1.

### *6.3.2 Proposals with Non-U.S. Participants*

In addition to the number of copies specified above, one additional copy of any proposal that includes any non-U.S. participants and/or institutional and governmental commitments must be sent to the address listed below.

The original and all copies of proposals shall include a letter of endorsement signed by an institutional official from each partner and each organization expecting to provide contributions of hardware, software, facilities etc. This official must certify institutional support and sponsorship of the investigation, as well as concurrence in the management and financial parts of the proposal. Non-U.S. organizations must submit the original of such endorsements to:

Ms. Wavalene Barnes  
Space Science and Aeronautics Division  
Code IS  
Ref: STEREO  
National Aeronautics and Space Administration  
Washington, DC 20546-0001  
Phone: 202-358-0900,

and a copy to:

STEREO Support Office  
Jorge Scientific Corporation  
Suite 700  
400 Virginia Avenue, SW  
Washington, DC 20024  
Fax Number: 202-554-2970

## 7.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

### 7.1 Evaluation Criteria and Procedures

The fundamental aim of this NASA investigation acquisition process is to identify scientific ideas and unique instrumental capabilities that best address the overall scientific objectives of the STEREO program as described in this AO. All proposals submitted in response to this AO will be subjected to a preliminary screening to determine their compliance to the constraints, requirements, and guidelines of the AO. Proposals not in compliance will be returned to the proposer without review. The following evaluation criteria (listed in descending order of priority) will be used in evaluating proposals submitted in response to this AO:

1. The scientific merit of the proposed investigation and its relevance to the specific opportunity described in this AO.
2. The technical merit and feasibility of the proposed investigation, with particular regard to its ability to supply the data needed to successfully complete the goals of the proposed investigation. The competence and relevant experience of the proposing investigation team will be evaluated as an indication of its ability to carry the investigation to a successful conclusion.
3. The fit of the investigation within the STEREO spacecraft resource and operations constraints identified in Section 5.1.3, Table 5-1.
4. The proposed total cost to NASA together with management practices and technical and cost risks (uncertainty) associated with the proposed investigation. Total NASA cost will be considered to include not only that proposed for any instrument development and for data analysis, but also the projected cost of the investigation during mission operations (through Phase E). Management aspects include the capability to deliver any proposed hardware on the schedule required by the STEREO project.
5. The plan for education, outreach, technology, small disadvantaged business, and Minority Institution activities. These requirements are described in Section 5.5.

The scientific and technical aspects of each proposal will be assessed by a panel of scientific and technical peers of the proposers. These panels may be augmented through the solicitation of mail-in reviews as well, which the panels have the option to accept, modify, or reject. A non-Government organization will be used by NASA to provide assistance in organizing and documenting this panel review process. The purpose of this peer evaluation will be to determine the scientific and technical merit, that is, criteria 1) and 2) above, of each proposal expressed in terms of its inherent strengths and weaknesses. The proposals will not be directly compared by this peer review panel.

Simultaneous with these above science reviews, proposals will be scrutinized for technical and fiscal integrity by NASA. The intent of these latter reviews will be, first, to assess the likelihood that any proposed hardware can be built using state-of-art techniques and be delivered within the mission schedule for STEREO; and second, to independently estimate the likely cost-to-NASA for the entire investigation as proposed. The technical fit to mission constraints, management, cost risk, and other (TMCO) evaluations will be done against criteria 3) through 5). Note that appropriate experts and professionals will evaluate the education and public outreach portions of the proposals. Once all evaluations are complete, a panel composed wholly of civil service personnel will convene to finalize the science peer review and TMCO results and categorize the proposals on the bases of criteria 1) and 2), in accordance with procedures required by Federal Acquisition Regulations (FAR) Supplement 1870.102. These Categories are defined below. Note that individual instruments, as well as their composite suites, will be categorized.

Category I. Well conceived and scientifically and technically sound investigation pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II. Well conceived and scientifically or technically sound investigations which are recommended for acceptance, but at a lower priority than Category I.

Category III. Scientifically or technically sound investigations which require further development.

Category IV. Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

## 7.2 Selection Procedures

The results of the proposal evaluations and categorizations will then be presented by the STEREO Program Scientist to the Space Science Steering Committee (SSSC), which is composed wholly of NASA Civil Servants and appointed by the Associate Administrator for Space Science. The SSSC will conduct an independent review of the evaluation and categorization processes regarding both their compliance to established policies and practices, as well as their completeness, self-consistency, and adequacy of all materials related thereto. After this review, the final evaluation and categorization results will be forwarded by the SSSC to the Associate Administrator who will make the final selections. The overriding consideration for the final selection of proposals submitted in response to this AO will be to maximize scientific return within the available budget. However, note that the merits of the submitted E/PO proposal will play a role in selection as noted in Section I of Appendix E.

It should also be noted that NASA reserves the right to select only a portion of a proposer's investigation and/or to invite his/her participation with other investigators in a joint investigation. In that case, all affected proposers will be given the opportunity to accept or decline such partial acceptance and/or participation with other investigators (See Appendix A, Section II).

Following selection, direct responsibility for establishing a contract with the institution of the Principal Investigator of the STEREO Investigation Team will be assigned to the STEREO Project Office at the NASA Goddard Space Flight Center. It is expected that funding for the Phase A Studies will begin quickly thereafter.

### 7.3 Implementation Procedures

Following selection, the PI's of the selected investigations will be notified immediately by telephone followed by formal written notification. The formal notification may include any issues noted during the evaluation that will require resolution and any special instructions for the concept study. A Project Initiation Conference will be held as soon as possible after selection to clarify requirements and responsibilities of all parties having roles in the mission. Proposers of investigations that were not selected will be notified in writing and offered a debriefing.

It is anticipated that contracts will be awarded for Phase A concept studies for investigations selected as a result of this AO. Each contract will contain a priced option for a bridge phase, to be exercised upon authorization to proceed. The bridge phase is intended to cover a two month period of Phase B effort to provide program continuity while the Phase B/C/D/E contract negotiations are completed.

The product of the concept studies will be reports to be delivered at the conclusion of the Phase A concept study period. NASA may request presentations and/or site visits to review the concept study results with the investigation teams. As a result of evaluation of the concept studies, NASA expects investigations to proceed toward flight by exercising their bridge phase options. However, NASA reserves the right to allow additional studies through Phase A and the right to confirm for flight by exercising contract options of investigations or portions of investigations as described in Appendix A, Section II.

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Space Science and Aeronautics Division within the Office of External Relations, will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail a letter of notification by NASA with a subsequent exchange of letters between NASA and the sponsoring governmental agency or a formal agency-to-agency Memorandum of Understanding (MOU).

During the Phase B timeframe, NASA will conduct an independent review of the investigation's readiness to proceed before being authorized to spend more than 25 percent of the total NASA commitment for Phases A/B/C/D. Results of this Confirmation Review and a decision to proceed (or not) will be rendered within 30 days of the review. This decision will be based upon review of the Phase B results, and evidence of satisfactory technical, cost, and schedule performance.

## 8.0 CONCLUSION

The objectives of the STEREO mission represent a significant step in accomplishing the goals of the Sun-Earth Connection program. NASA invites both the U.S. and international space science communities to participate in proposals for STEREO investigations to be carried out as a result of this Announcement.

George L. Withbroe  
Science Program Director  
The Sun-Earth Connection

Edward J. Weiler  
Associate Administrator for  
Space Science

## APPENDIX A

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### GENERAL INSTRUCTIONS AND PROVISIONS

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#### I. INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that becomes available, with or without modification, that will meet the investigative objectives.

NOTICE TO ALL OFFERORS: In the event that a Principal Investigator employed by NASA is selected under this AO, NASA will award prime contracts to non-Government participants, including Co-Investigators, hardware fabricators, and service providers who are named members of the proposing team, as long as the selecting official specifically designates the participant(s) in the selection decision. Refer to Section G of Appendix B of this AO for proposal information which the selecting official will review in determining whether to incorporate a non-Government participant in the selection decision. Each NASA contract with hardware fabricators or service providers selected in this manner will be supported by an appropriate justification for other than full and open competition, as necessary.

#### II. TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

#### III. SELECTION WITHOUT DISCUSSION

The Government reserves the right to reject any or all proposals received in response to this AO when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion (other than discussions conducted for the purpose of minor clarification). It is, therefore, emphasized that all proposals must be submitted initially on the most favorable terms that the offeror can submit.



#### IV. NONDOMESTIC PROPOSALS

The guidelines for proposals originating outside of the United States are the same as those for proposals originating within the United States, except that the additional conditions described in Section 5.2 of the AO and in Section F, paragraph 3 of Appendix B shall also apply.

#### V. TREATMENT OF PROPOSAL DATA

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. Information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice. To prevent inadvertent disclosure, proposal data shall not be included in submissions (e.g. final reports) that are routinely released to the public.

#### RESTRICTION ON USE AND DISCLOSURE OF PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in (insert page numbers or other identification) of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

#### VI. LATE PROPOSALS

The Government reserves the right to consider proposals or modifications thereof received after the date indicated, should such action be in the interest of the Government.

#### VII. (RESERVED)

#### VIII. DISCLOSURE OF PROPOSALS OUTSIDE GOVERNMENT

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal the investigator and institution agree

that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution must so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

#### IX. EQUAL OPPORTUNITY

By submitting a proposal, the investigator and institution agree to accept the following clause in any resulting contract:

##### EQUAL OPPORTUNITY

During the performance of this contract, the Contractor agrees as follows:

- A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.
- B. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to (1) employment, (2) upgrading, (3) demotion, (4) transfer, (5) recruitment or recruitment advertising, (6) layoff or termination, (7) rates of pay or other forms of compensation, and (8) selection for training, including apprenticeship.
- C. The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.
- D. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
- E. The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding the notice to be provided by the Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.
- F. The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

- G. The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.
- H. The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.
- I. If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, the contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.
- J. The Contractor shall include the terms and conditions of subparagraph 1 through 9 of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.
- K. The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

#### X. PATENT RIGHTS

- A. For any contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at 1852.227-70, New Technology, shall apply. Such contractors may, in advance of a contract, request waiver of rights as set forth in the provision at 1852.227-71, Requests for Waiver of Rights to Inventions.
- B. For any contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, Patent Rights -- Retention by the Contractor (Short Form) (as modified by 1852.227-11), shall apply.

## XI. SMALL AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING

- A. Offerors are advised that, in keeping with Congressionally mandated goals, NASA seeks to place a fair portion of its contract dollars, where feasible, with small disadvantaged business concerns, women-owned small business concerns, Historically Black Colleges and Universities, and minority educational institutions, as these entities are defined in 52.219-8 and in 52.226-2 of the FAR. For this Announcement of Opportunity, NASA has established a recommended goal of 8 percent for the participation of these entities at the prime and subcontract level. This goal is stated as a percentage of the total contract value. NASA encourages all offerors to meet or exceed this goal to the maximum extent practicable and to encourage the development of minority businesses and institutions throughout the contract period. Offerors will be evaluated on the proposed goal for participation of the entities listed above in comparison with the 8 percent goal and on the methods for achieving the proposed goal.
- B. Offerors are advised that for NASA contracts resulting from this solicitation which offer subcontracting possibilities, exceed \$500,000, and are with organizations other than small business concerns, the clause FAR 52.219-9 shall apply. Offerors who are selected under this AO will be required to negotiate subcontracting plans which include subcontracting goals for small, small disadvantaged, and women-owned small business concerns. Note that these specific subcontracting goals differ from the 8 percent goal described in paragraph A above, and need not be submitted with the proposal. Failure to submit and negotiate a subcontracting plan after selection shall make the offeror ineligible for award of a contract.

## APPENDIX B

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### SPECIFIC GUIDELINES FOR PROPOSAL PREPARATION IN RESPONSE TO THIS AO

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The following guidelines apply to the preparation of proposals by potential investigators in response to this STEREO Announcement of Opportunity (AO). The guidelines apply to both science investigations to be flown on the STEREO spacecraft and STEREO-related Missions of Opportunity. The material presented is a guide for the prospective proposer, and is not intended to be all encompassing. The proposer must, however, provide information relative to those items applicable or as otherwise required by the Announcement of Opportunity. In the event of an apparent conflict between the guidelines in this Appendix and those contained within the body of the AO, those within this Appendix shall take precedence.

#### GENERAL GUIDELINES

All documents must be typewritten in English, use the metric system of units, and be clearly legible. Submission of proposal material by facsimile (fax), electronic media, videotape, floppy disk, etc., is not acceptable. In evaluating proposals, NASA will only consider printed material. No proposal may reference a WWW site for any data needed to understand or complete the proposal.

The proposal must consist of only one volume, with readily identified sections corresponding to sections A through H given below. Proposals shall adhere to the page limits in Table B-1, including no more than two fold-out pages (28 x 43 cm; i.e., 11 x 17 inches) that count as one page each. All pages other than fold-out pages shall be 8.5 x 11 inches or A4 European standard. The cover, table of contents, required cost table(s) and appendices will not be counted against the page limit; for the remainder, every side upon which printing appears will be counted against the page limits.

Single- or double-column format is acceptable. In complying with the page limit, no page shall contain more than 55 lines of text and the type font shall not be smaller than 12-point Times (i.e., no more than 15 characters per inch). Smaller font is allowed within figures and in the cost table(s).

In order to allow for recycling of proposals after the review process, all proposals and copies must be submitted on plain white paper only (e.g., no cardboard stock or plastic covers, no colored paper, etc.). Proposers are not permitted to use three-ring binders. Photographs and color figures are permitted if printed on recyclable white paper only. The original signed copy (including cover and endorsements) must be bound in a manner that makes it easy to disassemble for reproduction. Except for the original, two-sided copies are preferred.

Table B-1. Proposal Page Guideline

<u>Section</u>	<u>Page Limits</u>
Cover Page and Proposal Summary	Printout of electronic submission
Table of Contents	1
Science Investigation Description	25 plus 4 pages each per additional instrument if a suite of instruments is proposed
Education/Public Outreach	5 (and also submitted electronically, see Section D)
Technology, and Small, Disadvantaged Business/Minority Institution Plan	2
Mission Operations Support and Data Analysis Plan	4 plus 1 page each per additional instrument if a suite of instruments is proposed
Management, Schedule, Cost Estimating Methodology, and Costs	10 plus 2 page each per additional instrument, plus required cost table(s)
<u>Appendices</u> (No others permitted): Phase A Contract (from model provided) Resumes (2 pages maximum for the PI and each Co-I) Statement of commitment from each Co-I Letter(s) of endorsement from participating institution(s) Statement(s) of Work References Description of Team Member Selection (NASA PI's only)	No page limit but small size encouraged

The content of each proposal shall be as follows:

A. COVER PAGE AND PROPOSAL SUMMARY

A Cover page and proposal summary must be a part of the proposal, but will not be counted against the page limit. It must be signed by the Principal Investigator and an official by title of the investigator's organization who is authorized to commit the organization. This

authorizing signature now also certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix D. Certifications do not need to be submitted separately.

The full names of the Principal Investigator and the authorizing official, their addresses with zip code, telephone and fax numbers, and electronic mail addresses, shall be included in the cover. Additional information, including the names, institutions, and E-mails of all participants, type of instrument(s) proposed, total investigation cost, and a 200-word summary shall also be included.

The Cover Page and Proposal Summary must be submitted electronically to the WWW site located at <<http://props.oss.hq.nasa.gov/>>. A hard copy version of this Cover must be printed in time to acquire signatures and include with the original hard copy of the proposal for delivery according to the schedule provided in Section 4.0 in this AO. Proposers are advised that they must not reformat this Cover when it is printed, as important NASA-required documentation may be lost. Proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: [dtripp@hq.nasa.gov](mailto:dtripp@hq.nasa.gov)) for assistance. Please note that submission of the electronic Cover does not satisfy the deadline for proposal submission.

It is NASA's intent to enter the Summaries of all selected investigations for its various programs into a publicly accessible database. Therefore, the Summary must not contain any proprietary or confidential information that the submitter wishes to protect from public disclosure.

## B. TABLE OF CONTENTS

The proposal must contain a Table of Contents. This Table of Contents must parallel the outlines provided below in Sections C through G.

## C. SCIENCE INVESTIGATION

The science section must describe the scientific objectives of the proposed investigation, including the value of the investigation to the STEREO mission objectives. A discussion of the scientific products and how the science products and data obtained will be used to fulfill the scientific objectives must be provided. A discussion of how the science data will be obtained, including a plan for delivery of the products, and the individuals responsible for the data delivery, must also be provided.

1. Scientific Goals and Objectives. This section must consist of a discussion of the goals and objectives of the investigation, their value to NASA's Sun-Earth Connection science theme and to the specific STEREO objectives described in this AO, and their relationships to past, current, and future investigations and missions. It must describe the history and basis for the proposal and discuss the need for such an investigation. The practical applications of the investigation, in relation to space weather forecasting, must also be outlined.

The measurements to be taken in the course of the mission, the data to be returned, and the approach that will be taken in analyzing the data to achieve the scientific objectives of the investigation must be discussed. This description must identify the investigation to be performed, the quality of the data to be returned (resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data to be returned (bits, images, etc.). The STEREO data downlink is likely to be limited and has to support all the instruments; consequently, proposers must justify their telemetry requirements in terms of the overall mission objectives. The relationship between the data products generated and the scientific objectives must be explicitly described. The improvement over current knowledge that the results of the investigation are expected to provide must be clearly stated.

Tradeoffs between data volumes, rates, and compression factors must be considered and any plans that can reduce the proposed instrument's drain on telemetry resources should be highlighted. In addition, proposers should note that at later times in the STEREO mission, when Earth-spacecraft distance has increased, real time commanding will be difficult, and thus plans for the development of command software must be provided.

## 2. Science Implementation.

- a. Instrumentation. This section must describe the instrumentation and the criteria used for its selection. While it is not expected that full details of instrument design will be available until completion of further studies, the information requested in the following paragraphs will aid in proposal review and, thus, must be provided to the extent known. This section must identify the individual components (including any mechanisms supplied by the proposer) and instrument systems, including their characteristics and requirements. In addition, the proposal must describe how the data that are to be obtained with the proposed hardware are related to that to be obtained from the other instruments of the model payload. Specific approaches being proposed to maximize the effective use of these data for the study of outstanding problems in solar physics must be identified together with the proposer's plans for data processing and management.

In particular, the proposal must describe all parameters of the instrument that are pertinent to the accommodation of the instrument within the spacecraft resources and configuration advertised in this AO (and updated on the same WWW site that contains this AO) plus any special requirements necessary for successful implementation. This information must be given in sufficient detail to permit an evaluation of both the concept and the practical feasibility of the hardware. These resources include, but are not limited to: volumetric envelope, mass, power and thermal requirements (including preferred thermal limits); telemetry and command requirements; environmental sensitivities (e.g. to electrical



cleanliness, magnetic fields, and contamination); any special spacecraft or launch vehicle integration requirements or constraints; pointing requirements; and on-board data processing. The power discussion must outline both cruise and peak power use, and a time profile of power needs. The instrument-level reserve for spacecraft resources such as mass and power must also be identified. Definitions for reserve and margin and some examples are given at the end of this section.

The proposal must outline items that are proposed to be developed, as well as any existing instrumentation or design/flight heritage. The heritage of various parts of the instrumentation, supporting systems, and software must be described. For any level of heritage claimed, cost information about the referenced sources of heritage will be required in the section on cost-estimating methodology.

In the case of proposals for multiple instruments, both individual instrument types and package parameters must be detailed to the extent possible. Proposals for multiple instruments are expected to justify each instrument type. Multiple-instrument proposals are expected to provide technical and cost information for each instrument sufficient to allow separate evaluation. This requirement also necessitates estimates of the fraction of shared resources ascribable to each instrument.

A preliminary description of the instrument design with a block diagram showing the instrument systems and their interfaces must be included. In the case of a new or not-yet-space-qualified instrument, the instrument must, to the extent possible, be compared on the basis of performance, complexity, and cost to existing instruments. Since the locations of the interfaces are not finalized, proposers must identify possible locations for the electrical, mechanical, and data interfaces based on information provided in this AO and updated on the same WWW site that contains this AO. In addition, the preferred location of the instrument itself on the spacecraft must also be described. Where more than one choice is available, proposers must identify and justify their preference. Proposals must include a discussion of the purpose of the instrument, data rates (peak and average), fields of view, resolution, sensitivity, pointing accuracy, etc. Instrument testing and calibration (both pre- and during flight) must also be described.

Definitions:

Contingency (or *reserve*) when added to a resource, results in the maximum expected value for that resource. Percent contingency is the proposed value of the contingency divided by the value of the resource less the contingency.

Margin is the difference between the maximum possible value of a resource as given in this AO (the physical limit or the agreed-to limit) and the maximum proposed value for a resource. Percent margin for a resource is the available margin divided by its maximum proposed value.

Example: A payload in the design phase has an estimated mass of 115 kg including a proposed mass reserve of 15 kg. There is no other payload on the ELV and the ELV provider plans to allot to you the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass reserve is  $15/100 = 15\%$  and the mass margin is 85 kg or  $85/115 = 74\%$ .

Example: The end-of-mission life capability of a spacecraft power system is 200 watts. Your instrument is expected to use 50 watts, including 25% contingency. You are allotted 75 watts by the satellite provider. Your reserve is 10 watts and your margin is 25 watts, or  $25/50 = 50\%$ .

- b. Mission. The observing strategy, within the framework of the expected spacecraft performance, required for obtaining the necessary data with the proposed instrumentation must be described. Operational constraints and viewing and pointing requirements must be identified. The concept and the expected requirements for supporting mission operations must be given. Requirements for pre- or postlaunch ground operations support must be identified. Proposers with additional mission operations support beyond what is currently planned must include the cost for the additional support under Phase E in Table B-2. The planned support for mission operations is described in Section 5.1.4 of the AO.
- c. Data Collection, Analysis, and Archiving. For both STEREO investigations and investigations funded as a STEREO Mission of Opportunity, the data reduction and analysis plan, following delivery of the data to the ground, must be discussed, including the method and format of the data reduction, data validation, and preliminary analysis. The process by which data will be prepared for archiving must be discussed, including a list of the specific data products and the individual team members responsible for the data products. The plan must include a detailed schedule for the submission of raw and reduced data to the appropriate data archive in the proper formats, media, etc. Delivery of the data to the data archive must take place in the shortest time possible as specified by the NASA policy on open data access and Section 5.4 of the AO.

- d. Science Team. This section must identify the investigation science team. It is required that every Co-I's role and responsibilities be explicitly given in the proposal. NASA strongly encourages proposers to identify only the most critically important personnel to aid in the execution of their proposals. (Note: the inclusion of Co-I's who are judged by peer review to have either insignificant or unjustified roles in a proposed program of research will be considered a weakness for purposes of the evaluation of the proposal.) Additionally, the roles and responsibilities of any other science team member funded for the investigation (defined as meaning anytime in Phases A-D) must also be explicitly defined and the capabilities and experience of all Co-I's and funded science team members must be described. The names of all Co-I's and funded science team members must appear on the Cover Page and Proposal Summary. The PI must submit a resume or *Curriculum Vitae* (not to exceed the specified page limit) that includes his/her professional experiences, positions, and a bibliography of publications relevant to the proposal. Resumes or *Curriculum Vitae* of Co-I's and funded science team members must also be included in the appendices (see Section G below).

*Statement(s) of Commitment from Co-I's and/or Funded Science Team Member*

Every Co-I and funded science team member from a U.S. as well as a non-U.S. institution identified in the proposal must submit a brief, signed statement of commitment that acknowledges his/her participation, even if they are from the PI's own institution. In the case of more than one Co-I and/or funded science team member from a given institution, a single, multiply-signed statement is acceptable. Each statement should be addressed to the PI, may be a facsimile, and must contain the following, or approximately similar, language:

“I(we) acknowledge that I(we) am(are) identified by name as Co-Investigator(s) [or funded science team member(s)] to the investigation entitled <name of proposal> that is submitted by <name of Principal Investigator> to the <name of Announcement> NASA Research Announcement, and that I(we) intend to carry out all responsibilities identified for me(us) in this proposal. I(we) understand that the extent and justification of my(our) participation as stated in this proposal will be evaluated during peer review in determining the merits of this proposal.”

In addition, if that person or his/her institution will be providing or contributing hardware/software/ or other tangible services, a letter from that institution must also be included.

### *Current and Pending Support*

Information must be provided for all ongoing and pending projects and proposals that involve the proposing PI, Co-I's, and funded science team members.

Therefore, for each of the two categories of support awards as may exist at the time of the proposal submission deadline, namely,

- a) Current Support (for any of the period that overlaps with the proposal being submitted to this NRA) and
- b) Pending Support (including the proposal to this NRA),

the proposal must provide the following information for each such individual:

- Title of award or project;
- Program name (if appropriate) and sponsoring agency or institution (including point of contact);
- Proposed period of performance and budget; and
- Commitment by PI, Co-I, or funded science team member in fractions of a full time Work Year (WY).

### **D. EDUCATION, OUTREACH, TECHNOLOGY, AND SMALL DISADVANTAGED BUSINESS/MINORITY INSTITUTION PLAN**

The Education/Public Outreach, technology, and small disadvantaged business/minority institution sections shall provide a summary of the benefits offered by the mission beyond the scientific benefits. This plan must reflect the proposer's commitment to achieving the goals of the OSS education and outreach strategy as reflected in the Implementation Plan for that strategy. It must also reflect the use of new technology in the implementation of the investigations and the transfer of technology beyond NASA and the space science community. Plans are required for the proposed investigation's commitment to meet the small disadvantaged business participation goal of 8%.

Further information on the OSS broad approach to Education/Public Outreach, as well as points of contact for obtaining assistance in the writing of Education/Public Outreach plans, can be found in Appendix E. Guidance on the use of new technology in investigations can be found in the OSS Integrated Technology Strategy, which can be accessed at the WWW site <<http://nic.nasa.gov/oss/>>.

All portions of this plan must be included in the hard copy submission of the proposal, within the page limits outlined in Table B-1. In addition, the identical Education/Public Outreach plan and its budget must be submitted electronically by uploading its text to the secure WWW site at <<http://cass.jsc.nasa.gov/panel/>> by the same deadline as for the parent proposal. This site will provide complete instructions for accomplishing this activity using a wide variety of formats. Proposers without access to the WWW or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at <[panel@lpi.jsc.nasa.gov](mailto:panel@lpi.jsc.nasa.gov)> or by phone at (281) 486-2156 or -2166 for assistance.

Only the electronic version of the Education/Public Outreach plan will be evaluated; the hard copy submission is for completeness only. This electronic submission must be clearly linked to the parent proposal, by identifying the PI name, parent proposal title and, if available, the proposal number assigned to the parent proposal at the time of submission of the electronic cover.

#### E. MANAGEMENT AND SCHEDULE

This section must briefly summarize the investigator's proposed management approach. The management organization and decision-making process must be described and the teaming arrangement (as known) must be discussed. The responsibilities of team members, including contributors, and institutional commitments must be discussed. Unique capabilities that each team member organization brings to the team, as well as previous experience with similar systems and equipment, must be addressed. The specific roles and responsibilities of the Principal Investigator, Co-Investigators, and Project Manager must be discussed. The relationship between the PI, his/her team, the instrument provider(s) (if not the PI), and NASA must be outlined. Risk management and risk mitigation plans, including possible descope options with cost-savings indicated, particularly in the case of multiinstrument proposals, must be described.

Mission of Opportunity proposals must specifically address how the investigation team will relate with the sponsoring organization, for example:

- The status of the commitment from the spacecraft builder/owner or sponsoring organization to fly the proposed instrument or conduct the proposed investigation;
- If and how the proposed investigation relates to the spacecraft sponsor's overall mission objectives;
- The investigation development plan and how it fits in the development plan for the sponsor's mission; and/or
- How the operations plan for the proposed investigation fits within the mission of the sponsoring organization.

A Project schedule to meet the proposed launch date and covering all phases of the investigation must be provided. The schedule must include proposed major Project review dates, instrument development and delivery, instrument to spacecraft integration and test, any special launch vehicle integration issues, and mission operations and data analysis. Schedule reserve must be clearly identified.

#### F. COST ESTIMATING METHODOLOGY AND COSTS

The Cost Plan must provide an estimate of the total lifecycle cost to NASA of the investigation, along with sufficient technical information to allow the reliability of the figures to be judged. The assumptions on which the estimate is based must be stated, particularly with regard to any requested Government-furnished equipment and services. For purposes

of this cost estimate, the proposer should assume delivery of any hardware in accordance with the Project Schedule shown in Table 5-2. Proposal cost estimates must include clearly identified and sufficient reserves of both schedule and financial resources to ensure on-time delivery.

The Cost Plan must have two parts: a detailed total cost for the concept study (Phase A) that is expected to last for three months and an estimated cost plan for Phases B, C, D, and E. Firm, fixed-price Phase A contracts with a bridge option will be issued for the concept study while, in the meantime, the contract for Phase B through E is negotiated. Proposers must estimate the NASA Cost in the proposal and, if selected through this AO, in much more detail in the concept study report.

Because the interfaces between the instruments and the spacecraft have not been finalized, proposers are asked to break down the estimates to a level that allows the total costs associated with major subsystems of the hardware to be identified. Since cost details are not anticipated until the conclusion of the concept study, cost estimates in the proposal may be generated with models or cost estimating relationships from analogous investigations.

An investigation may be descoped to meet cost constraints; therefore, the proposer shall identify a prioritized risk management plan for the removal of science objectives, reduction of testing, etc. The decision points for achieving effective reductions in cost and schedule must be identified. The hardware and Project costs associated with the investigation at each level of descoping must be estimated and any resulting schedule savings must be outlined.

This section shall include a first-order estimated cost of the investigation that encompasses all proposed activities, including Phase A/B/C/D/E, development of the ground system if there are any special requirements needed to support the proposed instrument(s), fee, and contributions. DSN costs will be covered by the project, thus proposers need only include costs for data analysis-related activities in their Phase E estimates. Costs shall be consistent with the program requirements described in Section 5 of the AO. The amount to be costed in each fiscal year must be identified by providing the data in Table B-2, which will not be counted against the page limit, using at least the WBS elements identified in Table B-3 and any other items unique to the proposal. Costs for each instrument must be shown to an instrument-specific WBS. The top portion of Table B-2 requests cost data relative to the NASA Cost. The lower portion addresses both domestic and non-U.S. contributions. Table B-4 gives the NASA inflation index to be used to calculate real-year dollars.

Since NASA may wish to select only part of a proposed instrument suite, each instrument (pair) of a proposed suite must be costed separately on its own line(s) in Table B-2 and any savings that may be realized by packaging the instruments must be described and justified in the text or an additional table and subtracted from the total cost.

The methodology used to estimate the cost, for example, engineering estimate, specific cost model, past performance, and cost estimating relationships from analogous missions, must be discussed. If an estimate is based on heritage, the performance and cost parameters that the proposed system has in common with the previous system shall be provided. No matter

which estimation method is used, sufficient details must be provided in this section and in the technical description of the instrument(s) to allow reviewers to verify the estimate. Budget reserve strategy, including budget reserve levels as a function of mission phase, must be discussed.

1. Full Cost Accounting

NASA civil service labor and supporting NASA Center infrastructure must be costed on a full cost accounting basis. If NASA guidance for full cost accounting has not been fully developed by the closing date for proposal submission or for completion of the definition studies, NASA Centers may submit full cost proposals based on the instructions in the NASA Financial Management Manual, Section 9091-5, "Cost Principles for Reimbursable Agreements," or based on their own Center-approved full cost accounting models. Other Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the Managerial Cost Accounting Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.

2. Goods and/or Services Offered on a No Exchange of Funds Basis

Contributions of any kind, whether cash or noncash (property and services), to STEREO investigations by organizations other than the NASA Office of Space Science are welcome. Such contributions are not accounted against the mission cap. The value of the contributed goods and or services must be entered in the lower part of Table B-2. Values for all contributions of property and services shall be established in accordance with applicable cost principles. Such contributions may be applied to any part or parts of a mission. A letter of endorsement that contains a statement of financial commitment from each responsible organization offering to make a contribution to the investigation must be submitted with the proposals for all U.S. components. For non-U.S. components of proposals, see paragraph 3 below.

3. International Participation and Purchases of Non-U.S. Goods and Services

Participation by non-U.S. individuals and organizations as team members in STEREO investigations is welcomed. Participation may include, but is not limited to, the contribution of scientific instruments, and the subsequent sharing of the data from the mission, all on a no-exchange-of-funds basis. Contributions by international partners must be included in the cost estimate.

Proposers are advised that a contract or subcontract by a U.S. team with a non-U.S. participant using funds derived from NASA must meet NASA and Federal regulations. Proposers are further advised that these regulations will place an additional burden on investigation teams that must be explicitly included in discussions of the investigation's cost, schedule, and risk management. Information regarding regulations governing the procurement of foreign goods or services is provided in Appendix F.

Proposers for non-NASA OSS and also non-U.S. missions must recognize that all such proposals must be consistent, and in compliance with, all U.S. Government laws, regulations, and policies governing the export of hardware and/or technical data. Further, any such successful proposal will require the appropriate agreement(s) and export license(s). Therefore, all proposers for non-U.S. missions must contact the Space Science and Aeronautics Division, Office of External Relations, at NASA Headquarters at the address in Section G, below, during the preparation of the concept study to obtain information about U.S. Government laws or policies (e.g., export control), as well as NASA policy and procedures regulating international cooperation that may be relevant to the proposal.

## G. APPENDICES

The following additional information is required to be supplied with the proposal. This information can be included as Appendices to the proposal, and, as such, will not be counted within the specified page limit. NO OTHER APPENDICES ARE PERMITTED.

1. Phase A Contract. Provide a Phase A contract based on the model made available at the WWW site at< <http://explorer.larc.nasa.gov/explorer/mel.html>>
2. Resumes. Provide resumes or curriculum vitae for the PI, Co-I's, and funded science team members identified in the science section and named on the Cover Page and Proposal Summary. Resumes or curriculum vitae must be no longer than two pages in length each.
3. Letters of Endorsement. Letters of endorsement must be provided from all organizations offering to supply goods or services or make a contribution to the investigation. Letters of endorsement must be signed by both the lead representative from each organization represented on the team, and by institutional or Government officials authorized to commit their organizations to participation in the proposed investigation. In the case of science investigators who are providing their time, but not hardware/software or other tangible items, a letter from that investigator only will suffice. Copies of faxed or E-mailed letters from non-U.S. participants may be substituted in the hard copy proposals submitted by the deadline as long as signed letters are received by the date specified in the schedule provided in Section 4.0 in this AO. Non-U.S. organizations must submit the original letter to:

Ms. Wavalene Barnes  
Space Science and Aeronautics Division  
Code IS  
Ref: STEREO  
National Aeronautics and Space Administration  
300 E Street, SW  
Washington, DC 20546-0001  
Phone: 202-358-0900,



with a copy to:

STEREO Support Office  
Jorge Scientific Corporation  
Suite 700  
400 Virginia Avenue, SW  
Washington, DC 20024  
Fax Number: 202-554-2970

4. Statement of Work (SOW). For investigations managed from non-Government institutions, provide a SOW for all potential contracts with NASA. For investigations managed from Government institutions, provide a SOW as if the institution were non-Government. This SOW must include the requirement for a concept study report. In addition, the SOW must include general task statements for Phases B/C/D, and for Phase E for the investigation. All SOW's must include the following as a minimum: Scope of Work, Deliverables (including science data), and Government Responsibilities (as applicable). SOW's need not be more than a few pages in length.
5. References List: Proposals may provide a list of reference documents and materials cited in the proposal. The documents and materials themselves cannot be submitted except as a part of the proposal (i.e., within the page limits).
6. NASA Principal Investigator Proposing Teams: Proposals submitted by NASA employees as Principal Investigators must contain the following information concerning the process by which non-Government participants were included in the proposal. The proposal must (i) indicate that the supplies or services of the proposed non-Government participant(s) are available under an existing NASA contract; (ii) make it clear that the capabilities, products, or services of these participant(s) are sufficiently unique to justify a sole source acquisition; or (iii) describe the open process that was used for selecting proposed team members. While a formal solicitation is not required, the process cited in (iii) above must include at least the following competitive aspects: notice of the opportunity to participate to potential sources; submissions from and/or discussions with potential sources; and objective criteria for selecting team members among interested sources. The proposal must address how the selection of the proposed team members followed the objective criteria and is reasonable from both a technical and cost standpoint. The proposal must also include a representation that the Principal Investigator has examined his/her financial interests in or concerning the proposed team members and has determined that no personal conflict of interest exists. The proposal must provide a certification by a NASA official superior to the Principal Investigator verifying the process for selecting contractors as proposed team members, including the absence of conflicts of interest.

**Table B-2. Total Investigation Cost Funding Profile Template**  
**(FY costs in 1998 Dollars, Totals in FY 1999 (FY99\$) and Real-Year Dollars (RY\$))**

Item	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06 -07	Total (FY99\$)	Total (RY\$)
NASA Cost											
Concept Study											
Phase B/C/D:											
WBS 1.0											
1.1											
1.2											
1.3											
WBS 2.0											
2.1-2.n											
WBS 3.0											
WBS 4.0											
WBS 5.0											
WBS n.0											
Phase E*:											
WBS 1.3											
MO & DA											
E/PO**											
Total NASA Cost	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
Contributions:											
WBS 1.0											
.											
.											
.											
WBS n.0											
Total Contributions	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
										Instr. Suite Savings†	-\$
										Total Cost	\$

Costs must include all costs including overhead, G&A, and fee. Instrument costs must include the costs of two identical instruments and any spares.

\* Mission Operations (any costs associated with special requirements) and Data Analysis, Archiving, and Distribution. The STEREO Project will cover the costs of normal DSN use and other normal mission operations costs.

\*\* Education and/or Public Outreach. This budget line must also be included with the electronically submitted version of the E/PO plan (see section D of Appendix B).

† Any cost savings realized from packaging an instrument suite (compared with buying each instrument individually) must be described and justified in the text or an additional table and subtracted from total here.

Table B-3. WBS Elements

1.0	Management/Science support (including Co-Investigators) must include:
1.1	Prelaunch Mission Operation Systems/Ground Data Systems development
1.2	Instrument development
1.3	Postlaunch MO&DA
2.0	Individual instrument costs (as applicable and if available; repeat for each instrument of a suite) including:
	<ul style="list-style-type: none"> <li>• detector/focal plane array</li> <li>• optics</li> <li>• mechanisms</li> <li>• power distribution</li> <li>• structure</li> <li>• electronics</li> <li>• other major assemblies</li> <li>• integration/assembly/test</li> </ul>
3.0	Software development/data processing
4.0	Special launch service costs if applicable
5.0	Special ground data system costs if applicable

Table B-4. NASA Inflation Index

Fiscal Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Inflation Rate		3.1%	3.4%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%
Cumulative Inflation Index	1.000	1.031	1.066	1.101	1.138	1.175	1.214	1.254	1.295	1.338

## APPENDIX C

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### BIBLIOGRAPHY OF RELEVANT REPORTS AND RECOMMENDATIONS

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#### I. SUMMARY OF FORMAL PUBLISHED REPORTS

All of the following reports have been issued by the National Academy of Sciences since 1980 through the auspices of its Space Science Board (SSB), the SSB Committee on Solar and Space Physics (CSSP), the Committee on Solar-Terrestrial Research (CSTR) of the Board on Atmospheric Sciences and Climate, or one of several ad hoc panels (in particular, the Astronomy Survey Committees of 1982 and 1991, the Panel on the Physics of the Sun in 1985, and through NASA's Sun-Earth Connection Advisory Subcommittee (SECAS) and the Space Science Advisory Committee (SSAC)). The page numbers shown are those containing discussion and/or recommendations regarding solar coronal mass ejections, their role in energetic particle production, and their possible impacts on terrestrial processes and the habitability of space.

1980: Solar-System Space Physics in the 1980's/A Research Strategy (pp. 7–10, 16, 21–26, 45–53, 61–63)

1981: Solar-Terrestrial Research for the 1980's (pp. 11–14, 26–27, 43–53, 70–85, 134)

1982: Astronomy and Astrophysics for the 1980's/Volume 1: Report of the Astronomy Survey Committee (pp. 76–80)

1984: National Solar-Terrestrial Research Program (pp. 11–12, 25)

1985: An Implementation Plan for Priorities in Solar-System Space Physics (pp. 5–7, 14, 16, 22–23, 29–38)

1985: The Physics of the Sun (pp. 14–15, 20–22, 44–46, 54–59, 61–62)

1988: Space Science in the Twenty-First Century: Imperatives for the Decades 1995–2015: Solar and Space Physics (pp. 7–10, 17–20, 33–41, 112–138)

1990: Office of Space Science and Applications Strategic Plan (pp. 11, 29, 34, 57)

1991: The Decade of Discovery in Astronomy and Astrophysics/Astronomy and Astrophysics Panel Reports (pp. ix 3, ix 5–11, ix 21–22)

1991: Space Physics Strategy -- Implementation Study -- The NASA Space Physics Program for 1995–2010, Vol. 1, (pp. 9–11, 68–75, 143–144)

1991: Assessment of Programs in Solar and Space Physics (pp. 9–13)

1994: Solar Influences on Global Change (pp. 9–11, 106)

1995: A Science Strategy for Space Physics (pp. 2–3, 23–37, 64–71, 74)

1997: Sun-Earth Connection Roadmap: Strategic Planning for the Years 2000–2020 (pp. 19, 21, 25–38, 51–56, 98–99)

1997: The Space Science Enterprise Strategic Plan (pp. 4–7, 15, 19, 23–27, A1, A3, A4)

1997: An Assessment of the Solar and Space Physics Aspects of NASA’s Space Science Enterprise Strategic Plan (p. 4)

## II. EDUCATION OUTREACH

Documentation on Education/Public Outreach and other relevant subjects can be found on-line at the “Education and Public Outreach” OSS WWW home page at  
<<http://www.hq.nasa.gov/office/oss/>>.

“Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA’s Space Science Programs” (March 1995).

This document describes the overall strategy for integrating education and public outreach into NASA’s space science programs. It may be found at the WWW site at  
<<http://www.hq.nasa.gov/office/oss/edu/educov.htm>>

“Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy” (October 1996)

This document describes OSS’s overall approach to implementing its Education/Public Outreach strategy. It may be found at the WWW site at  
<[http://www.hq.nasa.gov/office/oss/edu/imp\\_plan.htm](http://www.hq.nasa.gov/office/oss/edu/imp_plan.htm)>

## III. NEW TECHNOLOGY PLANS

“OSS Integrated Technology Strategy” (April 1994).

Describes efforts to manage technology infusion into future OSS missions and to promote technology transfer to the private sector. It may be found at the WWW site at  
<<http://nic.nasa.gov/oss/>>

## IV. NASA POLICY

NHB 7120.5 -- Management of Major System Programs and Projects (November 1993)

This NASA Handbook provides a reference for typical activities, milestones, and products in the development and execution of NASA missions.

## APPENDIX D

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### CERTIFICATIONS

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#### Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

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The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

---

Organization Name

AO or NRA Number and Title

---

Printed Name and Title of Authorized Representative

---

Signature

Date

---

Printed Principal Investigator Name

Proposal Title

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CERTIFICATION REGARDING  
DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS  
PRIMARY COVERED TRANSACTIONS

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This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1265.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification;
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -- Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- (a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- (b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

---

Organization Name

---

AO or NRA Number and Title

---

Printed Name and Title of Authorized Representative

---

Signature

---

Date

---

Printed Principal Investigator Name

---

Proposal Title

---

CERTIFICATION REGARDING  
LOBBYING

---

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form -- LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

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Organization Name

---

AO or NRA Number and Title

---

Printed Name and Title of Authorized Representative

---

Signature

---

Date

---

Printed Principal Investigator Name

---

Proposal Title

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## APPENDIX E

### EDUCATION AND PUBLIC OUTREACH

#### I. SCOPE OF PROGRAM

The Office of Space Science (OSS) has developed a comprehensive approach for making education at all levels (with a particular emphasis on K-14 education) and the enhancement of public understanding of space science integral parts of all of its missions and research programs. The two key documents that establish the basic policies and guide all OSS Education and Outreach activities are a strategic plan, entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), and an implementation plan, entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both of these documents may be obtained either by selecting Education and Public Outreach from the menu on the OSS homepage at <http://spacescience.nasa.gov>, or from Dr. Jeffrey Rosendhal, Code S, Office of Space Science, NASA Headquarters, Washington, DC 20546-0001.

In accord with these established OSS policies, proposers to this AO are required to include an Education/Public Outreach (E/PO) program as part of their proposal. In keeping with this policy, proposed E/PO activities should be budgeted at one to two percent per year of the cost of the proposed investigation. E/PO proposals will be evaluated (see criteria below) by appropriately qualified scientific, education, and outreach personnel, and the results of those evaluations will be considered by the OSS Selecting Official as a part of the overall evaluation and selection process. E/PO will serve as one of the factors to be used in discriminating among proposals having otherwise comparable scientific and technical merits.

#### II. EVALUATION CRITERIA

There are two classes of evaluation criteria against which proposed E/PO activities will be evaluated. The general criteria to be applied to the evaluation of all proposals, which reflect requirements necessary for further consideration of a proposal, are:

- The quality, scope, and realism of the proposed E/PO program including the adequacy, appropriateness, and realism of the proposed budget;
- The capability and commitment of the proposer and the proposer's team and the direct involvement of one or more science team members in overseeing and carrying out the proposed E/PO program;
- The establishment or continuation of effective partnerships with institutions and/or personnel in the fields of education and/or public outreach as the basis for and an integral element of the proposed E/PO program;

- The adequacy of plans for evaluating the effectiveness and impact of the proposed education/outreach activity.

To ensure that the goals and objectives of the OSS E/PO strategy are realized in practice, proposals will also be evaluated using the following specific criteria. Based on the funding guidelines given elsewhere in this AO, the E/PO programs submitted in response to this Announcement will involve the expenditure of substantial resources. Therefore, it

is expected that proposed E/PO programs will have a breadth and depth commensurate with these resources. Such programs are expected to be multi-faceted in nature, address a number of different aspects of education and outreach contained in the specific criteria, and have state, regional, or national scope. The specific E/PO criteria are:

- For proposals dealing directly with or strongly affecting the formal education system (e.g., through teacher workshops or student programs carried out at informal education institutions such as science museums and planetariums), the degree to which the proposed E/PO effort is aligned with and linked to nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The degree to which the proposed E/PO effort contributes to the training of, involvement in, and broad understanding of science and technology by underserved and/or underutilized groups;
- The potential for the proposed E/PO activity to expand its scope by having an impact beyond the direct beneficiaries, reaching large audiences, being suitable for replication or broad dissemination, or drawing on resources beyond those directly requested in the proposal.

Although creativity and innovation are certainly encouraged, note that neither of these sets of criteria focuses on the originality of the proposed effort. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and the PI and/or appropriate research team members will actively be involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been planned and will be executed; and that the proposed investment of resources will make a significant contribution toward meeting OSS E/PO plans and objectives.

To aid proposers in the preparation of their proposals, as well as to ensure that reviews are carried out on a consistent basis aligned with the OSS Education Strategy and Implementation Plan, an *Explanatory Guide* to the E/PO evaluation criteria has been prepared and may be found by linking through *Education and Public Outreach* at the Web site <<http://www.spacescience.nasa.gov>>.

### III. ASSISTANCE FOR THE PREPARATION OF E/PO PROPOSALS

NASA OSS has established a nation-wide infrastructure of space science education/public outreach groups whose purpose is to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. Of particular interest are two elements of this system (which are also described in more detail in the OSS education/outreach implementation plan referred to above):

1. Four OSS science theme-oriented E/PO "Forums" have been established to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science missions and research programs, and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
2. Five regional E/PO "Broker/Facilitators" to search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported scientists, and help scientists turn results from space science missions and programs into educationally-appropriate activities suitable for regional and/or national dissemination

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate alliances. Proposers should be careful to note that these Forums and Broker/Facilitators have been established to provide help, but the responsibility for actually developing the E/PO program and writing the proposal is that of the proposer. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators may be found by opening Education and Public Outreach from the menu of the OSS homepage at <<http://www.spacescience.nasa.gov>>.

### IV. PREPARATION AND SUBMISSION OF AN E/PO PROPOSAL

In order to be considered for evaluation, E/PO proposals must adhere to the following formats and also must be submitted both electronically and in hard copy as described below.

An E/PO proposal is to consist of a contiguous body and budget:

- The body of the E/PO proposal is limited to five pages (<21,150 characters, including spaces, using the fonts and page layouts specified in the appropriate Guidelines for Proposal Preparation appendix) and must include the following parts: a brief abstract of the proposed activity (not to exceed 800 characters); an expanded description of the E/PO objectives and planned activities; a description of the intended involvement of the Principal Investigator and/or key science team members in the proposed E/PO effort; a description of any educational personnel who are involved in the effort, including proposed partnership institutions

(together with specific indicators of commitment on the part of partners where appropriate); a description of how the effort will be managed; and an explanation of the requested E/PO budget. Note that the PI or one of the science team members of the parent research proposal must have the prime responsibility for overseeing the implementation of the proposed E/PO activity. The responsible individual should be clearly identified in the body of the E/PO proposal.

- The period of performance of an E/PO activity is generally expected to coincide with that of the proposed investigation throughout all phases including the data analysis phase. The E/PO budget must be summarized for its entire intended total period of performance, as well as for each individual year thereof, using the format entitled Budget Summary for Education/Public Outreach Proposals given at the end of this Appendix (e.g., an E/PO effort proposed for a five year period of performance will require six budget sheets). In addition, this E/PO budget must be integrated into the budget for the entire proposed investigation as specified elsewhere in this AO.
- E/PO proposals (both body and budget) must be submitted by each of two separate ways:
  - As an electronic submission (for the evaluation process) by uploading it, including its Budget Summary sheets, to the secure Web site <http://cass.jsc.nasa.gov/panel/>, which provides instructions for this activity using a wide variety of formats. Proposers without Web access or who experience difficulty in using this site may request assistance from the Lunar and Planetary Institute by E-mail at [panel@lpi.jsc.nasa.gov](mailto:panel@lpi.jsc.nasa.gov) or by phone at (281) 486-2136; and
  - As part of the total hard-copy version of the research proposal (see the ordered list of component parts for proposals elsewhere in this AO).

## V. ADDITIONAL INFORMATION

Following selection of investigations, all investigator teams will be expected to work together to create, design, plan, and implement a coordinated and integrated program of Education/Public Outreach activities for this mission opportunity. Such a program may involve coordination of individually proposed E/PO efforts, the development of appropriate collaborative activities, and/or the identification of new E/PO opportunities that build on and/or extend the unique capabilities, connections, partnerships, and resources that are brought into the mission by individual selected investigations. Development of plans for such a coordinated E/PO program will be part of the Phase A study activity.

General questions about the OSS E/PO program may be directed to:

Dr. J. David Bohlin  
 Code SR  
 Office of Space Science  
 NASA Headquarters  
 Washington, DC 20546  
 E-mail: [david.bohlin@hq.nasa.gov](mailto:david.bohlin@hq.nasa.gov)  
 Telephone: 202/358-0880

**BUDGET SUMMARY**  
**for**  
**EDUCATIONAL/PUBLIC OUTREACH PROPOSAL**

**For** (check one):

\_\_\_\_ **Total Period of Performance from (M/D/Y)** \_\_\_\_\_ **to** \_\_\_\_\_  
**/or/**  
\_\_\_\_ **Year** \_\_\_\_\_ **of** \_\_\_\_\_ **from (M/D/Y)** \_\_\_\_\_ **to** \_\_\_\_\_

1. Direct Labor (salaries, wages, and fringe benefits) \_\_\_\_\_
2. Other Direct Costs:
  - a. Subcontracts \_\_\_\_\_
  - b. Consultants \_\_\_\_\_
  - c. Equipment \_\_\_\_\_
  - d. Supplies \_\_\_\_\_
  - e. Travel \_\_\_\_\_
  - f. Other \_\_\_\_\_
3. Facilities and Administrative Costs \_\_\_\_\_
4. Other Applicable Costs: \_\_\_\_\_
5. SUBTOTAL--Estimated Costs \_\_\_\_\_
6. Less Proposed Cost Sharing (if any) \_\_\_\_\_
8. Total E/PO Estimated Costs \_\_\_\_\_

## APPENDIX F

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### REGULATIONS GOVERNING PROCUREMENT OF FOREIGN GOODS OR SERVICES

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The following Federal Acquisition Regulation (FAR) clauses cover the purchase of foreign goods and services and may be included in contracts resulting from this Announcement of Opportunity:

- |           |  |
|-----------|--|
| 52.225-3  | Buy American Act -- Supplies (January 1994)  |
| 52.225-7  | Balance of Payments Program (April 1984)   |
| 52.225-9  | Buy American Act -- Trade Agreements -- Balance of Payments Program (January 1994)                                       |
| 52.225-10 | Duty-Free Entry (April 1984)   |
| 52.225-11 | Restrictions on Certain Foreign Purchases (May 1992)   |
| 52.225-17 | Buy American Act -- Supplies Under European Community Agreement (May 1995)   |
| 52.225-18 | European Community Sanction for End Products (May 1995)  |
| 52.225-19 | European Community Sanction for Services (May 1995)  |
| 52.225-21 | Buy American Act -- North American Free Trade Agreement Implementation Act -- Balance of Payments Program (January 1994) |

The proposer is directed to the Federal Acquisition Regulation and the NASA FAR Supplement for further information on these regulations.